

REMARKS

Claims 1-5 are pending. Claims 1 and 3 have been amended. Reconsideration and allowance of the present application based on the following remarks are respectfully requested.

In the Abstract

The Abstract was objected to. Applicants have amended the Abstract to correct the informality identified by the Examiner. A clean copy of the amended Abstract is included on a separate sheet as required. Accordingly, Applicants respectfully request withdrawal of this objection.

Claim Rejections Under 35 U.S.C. § 112

Claims 1-5 were rejected under 35 U.S.C. § 112, first paragraph and second paragraph. Applicants have amended the claims to correct the informalities identified by the Examiner in connection with the rejection under 112, second paragraph. With respect to the remaining rejections, Applicants respectfully submit that the details the Office Action alleges are missing, are not missing or are routine within the art, such that no undue experimentation would be necessary. Additionally, Applicants provide herewith some detailed explanation of the items identified by the Examiner.

With respect to the camera calibration, all cameras have a focal length, a main position's position, and lens distortion. These are called interior orientations and a position of a camera's focal point and posture information are called exterior orientation. To obtain these values, a three-dimensional target, where position information for the target is already known, is installed. After that, target information is received in the same manner using two CCDs located to the right and left with a vehicle stopped. To obtain interior orientation, camera lens calibration is performed, and to obtain exterior orientation, camera orientation is performed.

With respect to integration of GPS/INS/DMI, a basic system that shoots an object when the object moves and extracts a 3D position of the object, requires the navigation sensors (i.e., the GPS, INS, and DMI) to obtain position and altitude of the vehicle. Although GPS provides position information of a vehicle over a long period of time, it is not able to receive signals in an area where buildings are densely concentrated. INS can provide altitude and relative position of the vehicle for a short time but may generate errors over longer times. DMI can provide distance information of the vehicle for a short time, but may also generate errors over longer periods.

Therefore, integration of the three sensors is used to minimize these drawbacks and calculate position and altitude information.

With respect to integration of CCD/GPS/INS/DMI, to obtain a 3D position of an object, the above-described interior expression factors (a focal length, a main position's position, and lens distortion), an image containing an object for which 3D position extraction is desired, a position of a camera's focus, and altitude information when the image is photographed are required. To obtain this information when a vehicle moves, results from coupling of position and altitude information of a vehicle and exterior expression factors are required. In short, the integration block of CCD/GPS/INS/DMI uses this information to determine an offset between a focus of a sensor and navigation sensors installed different locations, respectively. Results reflecting offset determined in this process are expressed by "exterior orientation of CCD in moving vehicle", and the interior expression factors are expressed by "interior orientation of CCD".

With respect to 3D positioning, the interior expression factors (a focal length, a main position's position, and lens distortion), a position of a camera's focus, and attitude information are provided from the integration of CCD/GPS/INS/DMI. Images for an object for which 3D data is to be established while a vehicle moves are simultaneously obtained from the right and left CCDs. After that, 3D position information for an object is extracted, and then a database is established in cooperation with GIS (geographic information system) database.

As can be readily seen from the original specification and the above description, the details the Office Action alleges are missing, are not missing or are routine within the art, such that no undue experimentation would be necessary. Accordingly, Applicants respectfully request reconsideration and withdrawal of these rejections.

Conclusion

Therefore, all objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Should any issues remain unresolved, the Examiner is encouraged to contact the undersigned attorney for Applicants at the telephone number indicated below in order to expeditiously resolve any remaining issues.

Respectfully submitted,

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